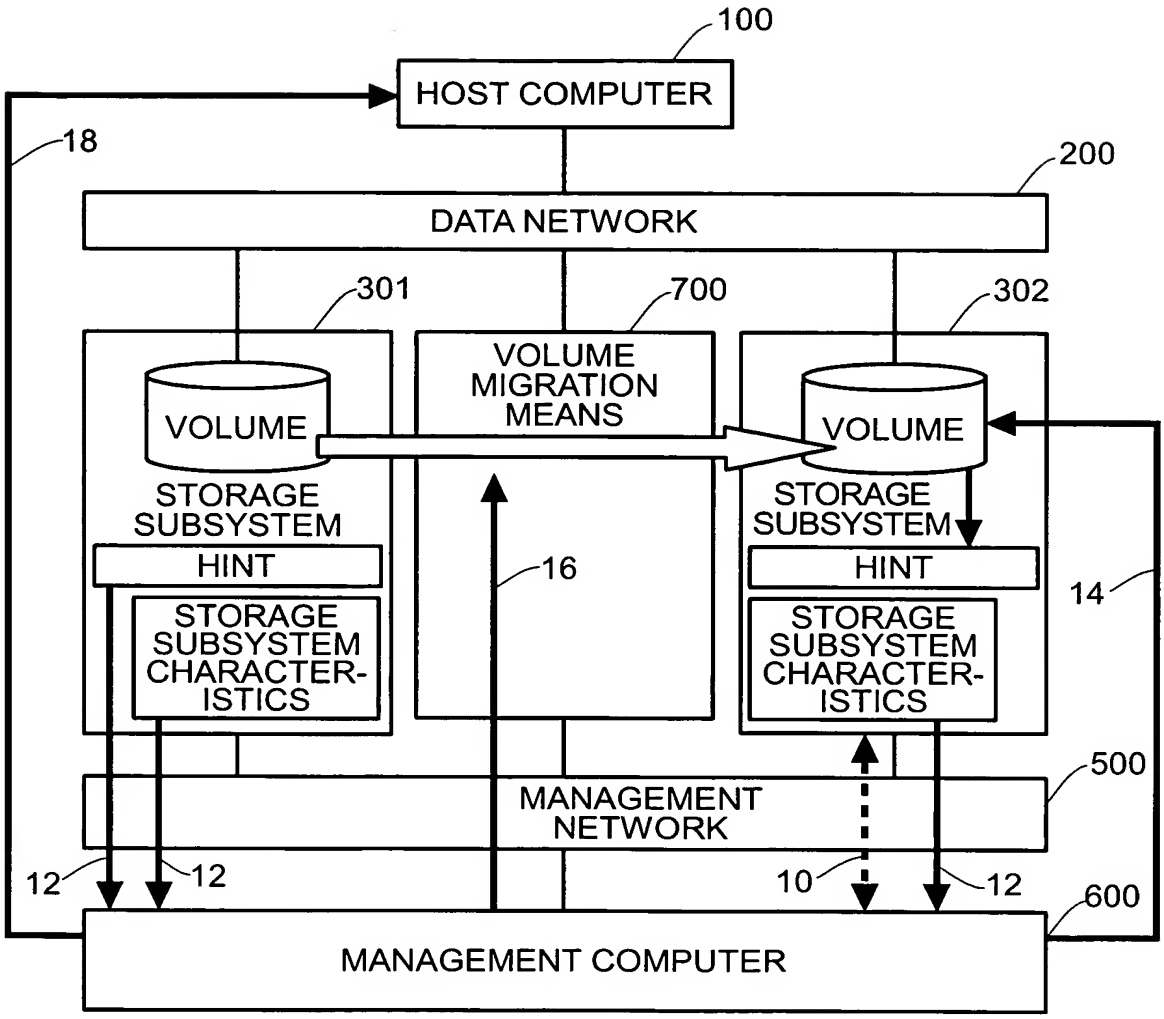
FIG.1


100
HOST COMPUTER
18
200
DATA NETWORK
301
700
302
VOLUME
VOLUME MIGRATION MEANS
VOLUME
STORAGE SUBSYSTEM
HINT
STORAGE SUBSYSTEM CHARACTER-ISTICS
16
STORAGE SUBSYSTEM
HINT
STORAGE SUBSYSTEM CHARACTER-ISTICS
14
500
MANAGEMENT NETWORK
12
12
10
12
600
MANAGEMENT COMPUTER

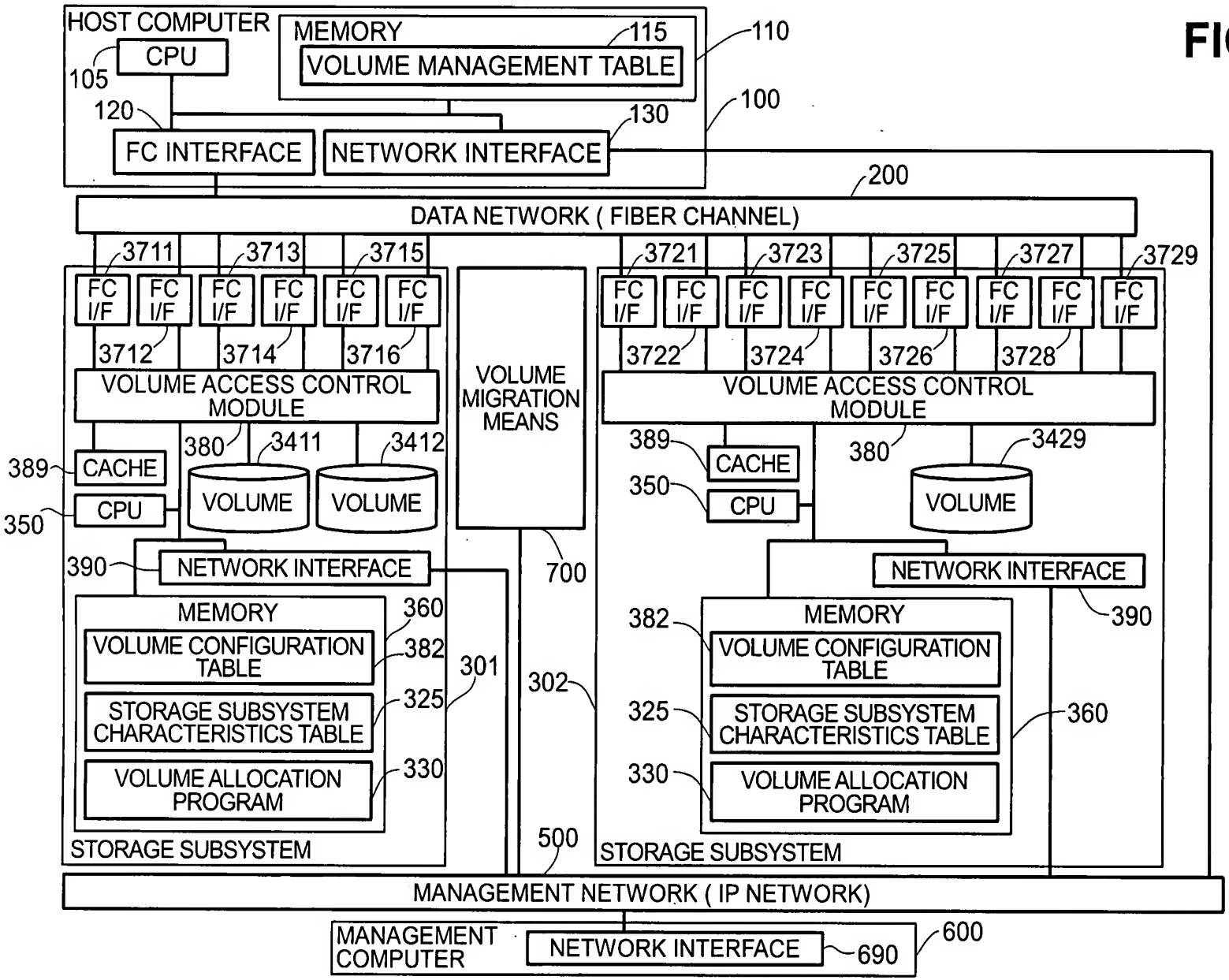

HOST COMPUTER
CPU
105
MEMORY
115
VOLUME MANAGEMENT TABLE
110
120
130
100
FC INTERFACE
NETWORK INTERFACE
200
DATA NETWORK (FIBER CHANNEL)
3711
3713
3715
3721
3723
3725
3727
3729
FC I/F
3712
3714
3716
3722
3724
3726
3728
VOLUME ACCESS CONTROL MODULE
VOLUME MIGRATION MEANS
389
380
3411
3412
3429
CACHE
CPU
350
VOLUME
390
NETWORK INTERFACE
700
MEMORY
360
382
VOLUME CONFIGURATION TABLE
301
302
325
STORAGE SUBSYSTEM CHARACTERISTICS TABLE
330
VOLUME ALLOCATION PROGRAM
STORAGE SUBSYSTEM
500
MANAGEMENT NETWORK (IP NETWORK)
MANAGEMENT COMPUTER
690
600

FIG.2

FIG.3

VOLUME ALLOCATION REQUEST	
CAPACITY	
AccessBandwidthHint	
StorageCostHint	
DataAvailabilityHint	

FIG.4A

326

Hint	Access Bandwidth	Storage Cost	Data Availability
0	Don't Care	Don't Care	Don't Care
1	1Gbps	1 ¢ /MB	99.9%
2	1Gbps	1 ¢ /MB	99.9%
3	1Gbps	1 ¢ /MB	99.9%
4	1Gbps	1 ¢ /MB	99.9%
5	1Gbps	1 ¢ /MB	99.9%
6	2Gbps	1 ¢ /MB	99.9%
7	2Gbps	1 ¢ /MB	99.9%
8	2Gbps	1 ¢ /MB	99.9%
9	2Gbps	1 ¢ /MB	99.9%
10	2Gbps	1 ¢ /MB	99.9%

FIG.4B

327

Hint	Access Bandwidth	Storage Cost	Data Availability
0	Don't Care	Don't Care	Don't Care
1	1Gbps	2 ¢ /MB	99.999%
2	1Gbps	2 ¢ /MB	99.999%
3	1Gbps	2 ¢ /MB	99.999%
4	1Gbps	2 ¢ /MB	99.999%
5	1Gbps	2 ¢ /MB	99.999%
6	2Gbps	2 ¢ /MB	99.999%
7	2Gbps	2 ¢ /MB	99.999%
8	2Gbps	2 ¢ /MB	99.999%
9	10Gbps	2 ¢ /MB	99.999%
10	10Gbps	2 ¢ /MB	99.999%

FIG.5A

ABH: AccessBandwidthHint
SCH: StorageCostHint
DAH: DataAvailabilityHint

383

VOLUME NUMBER	FC I/F NUMBER	CAPACITY	BANDWIDTH	VOLUME HINT INFORMATION		
				ABH	SCH	DAH
3412	3714	200GB	2Gbps	10	0	10

FIG.5B

383

VOLUME NUMBER	FC I/F NUMBER	CAPACITY	BANDWIDTH	VOLUME HINT INFORMATION		
				ABH	SCH	DAH
3412	3714	200GB	2Gbps	10	0	10
3411	3711	200GB	1Gbps	1	10	0

FIG.5C

383

VOLUME NUMBER	FC I/F NUMBER	CAPACITY	BANDWIDTH	VOLUME HINT INFORMATION		
				ABH	SCH	DAH
3411	3711	200GB	1Gbps	1	10	0

FIG.6A

115

DRIVE LETTER	FC INTERFACE NUMBER	VOLUME NUMBER	MIGRATION FLAG
C	3714	3412	0

FIG.6B

115

DRIVE LETTER	FC INTERFACE NUMBER	VOLUME NUMBER	MIGRATION FLAG
C	3714	3412	0
D	3711	3411	0

FIG.6C

115

DRIVE LETTER	FC INTERFACE NUMBER	VOLUME NUMBER	MIGRATION FLAG
C	3714	3412	1
D	3711	3411	0

FIG.6D

115

DRIVE LETTER	FC INTERFACE NUMBER	VOLUME NUMBER	MIGRATION FLAG
C	3727	3429	0
D	3711	3411	0

FIG.7A

ABH: AccessBandwidthHint
SCH: StorageCostHint
DAH: DataAvailabilityHint

384

VOLUME NUMBER	FC I/F NUMBER	CAPACITY	BANDWIDTH	VOLUME HINT INFORMATION		
				ABH	SCH	DAH

FIG.7B

384

VOLUME NUMBER	FC I/F NUMBER	CAPACITY	BANDWIDTH	VOLUME HINT INFORMATION		
				ABH	SCH	DAH
3429	3727	200GB	10Gbps	10	0	10

FIG.8A

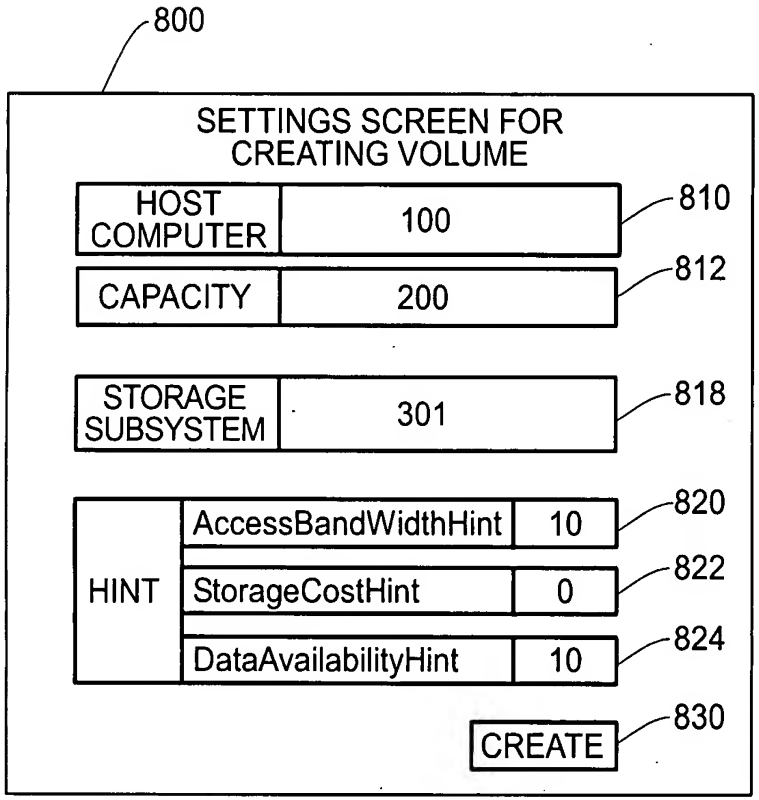
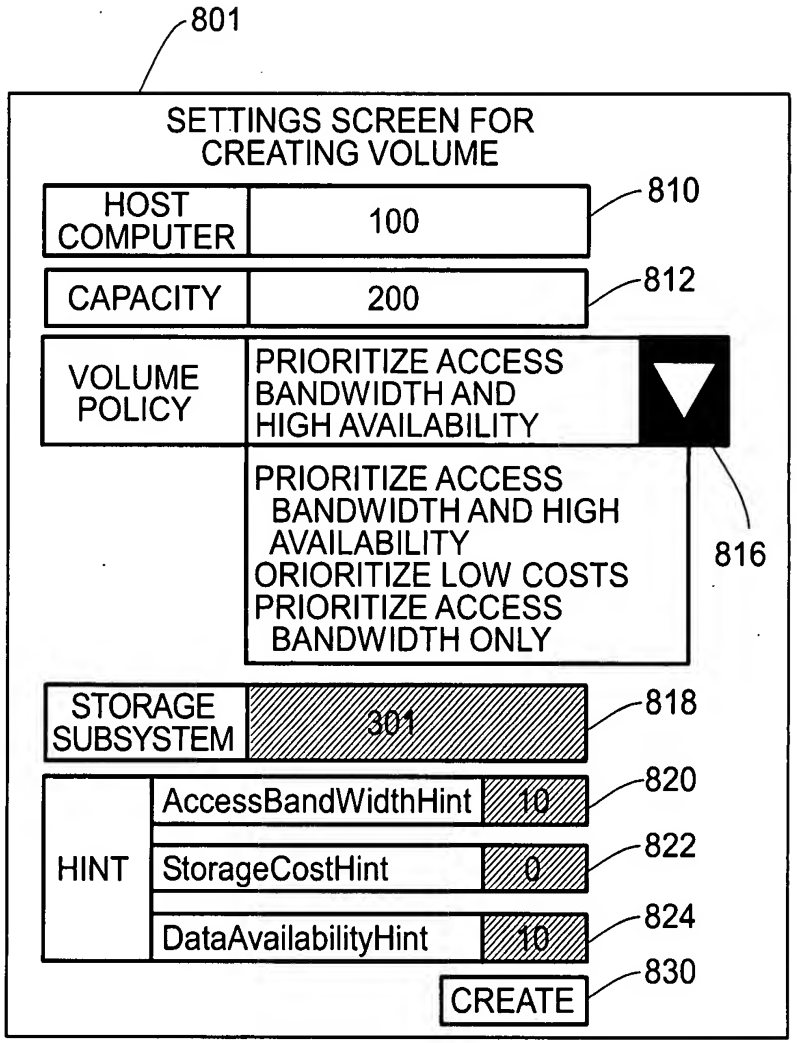

800
SETTINGS SCREEN FOR CREATING VOLUME
HOST COMPUTER
100
810
CAPACITY
200
812
STORAGE SUBSYSTEM
301
818
HINT
AccessBandWidthHint
10
820
StorageCostHint
0
822
DataAvailabilityHint
10
824
CREATE
830

FIG.8B


801
SETTINGS SCREEN FOR CREATING VOLUME
HOST COMPUTER
100
810
CAPACITY
200
812
VOLUME POLICY
PRIORITIZE ACCESS BANDWIDTH AND HIGH AVAILABILITY
PRIORITIZE ACCESS BANDWIDTH AND HIGH AVAILABILITY
ORIORITIZE LOW COSTS
PRIORITIZE ACCESS BANDWIDTH ONLY
816
STORAGE SUBSYSTEM
301
818
HINT
AccessBandWidthHint
10
820
StorageCostHint
0
822
DataAvailabilityHint
10
824
CREATE
830

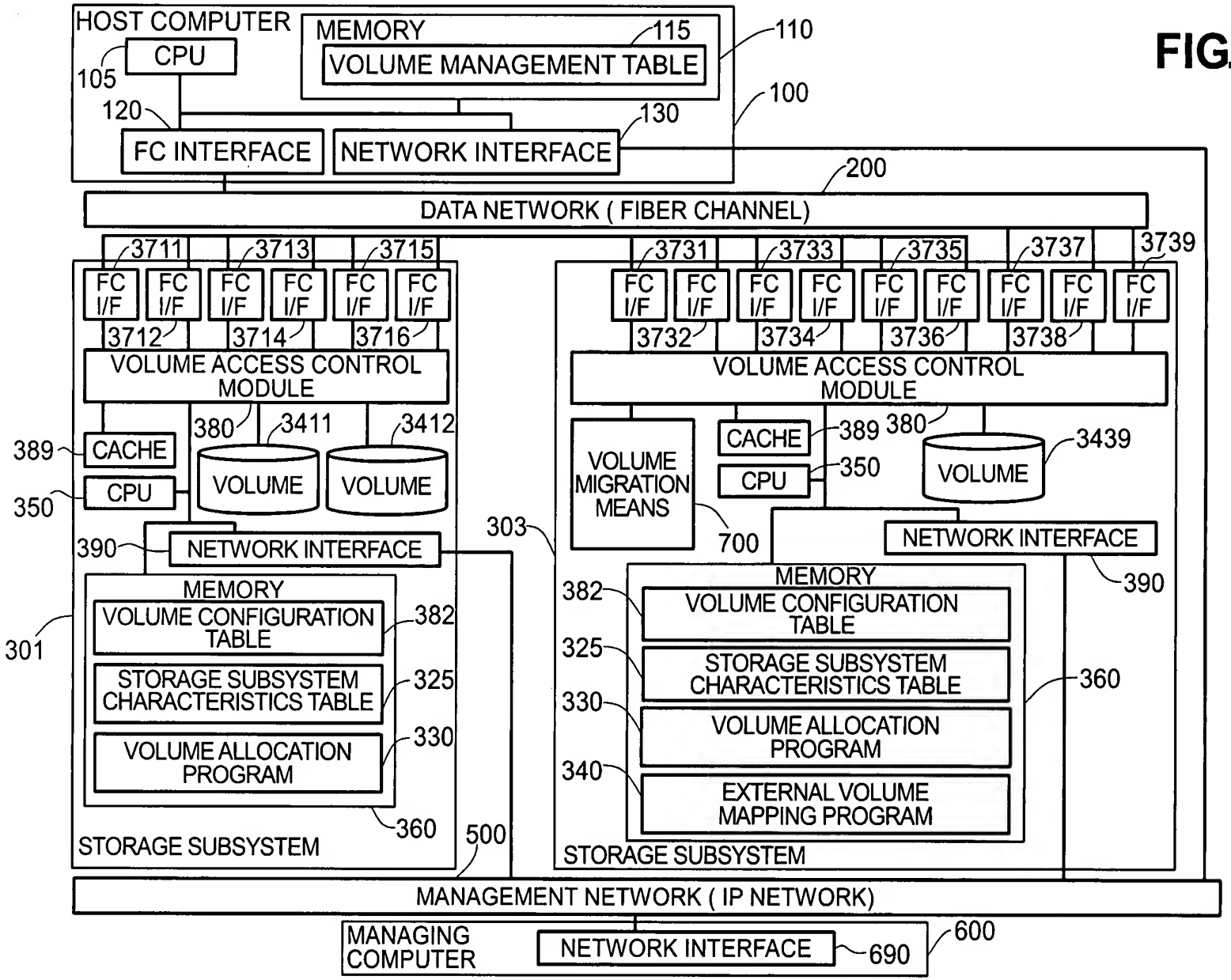

HOST COMPUTER
CPU
105
MEMORY
115
VOLUME MANAGEMENT TABLE
110
120
100
130
FC INTERFACE
NETWORK INTERFACE
200
DATA NETWORK (FIBER CHANNEL)
3711
3713
3715
3731
3733
3735
3737
3739
FC I/F
3712
3714
3716
3732
3734
3736
3738
VOLUME ACCESS CONTROL MODULE
389
CACHE
380
3411
3412
VOLUME
350
CPU
390
NETWORK INTERFACE
303
301
MEMORY
VOLUME CONFIGURATION TABLE
382
STORAGE SUBSYSTEM CHARACTERISTICS TABLE
325
VOLUME ALLOCATION PROGRAM
330
360
STORAGE SUBSYSTEM
500
VOLUME MIGRATION MEANS
700
3439
340
EXTERNAL VOLUME MAPPING PROGRAM
MANAGEMENT NETWORK (IP NETWORK)
MANAGING COMPUTER
690
600

FIG.9

ABH: AccessBandwidthHint
SCH: StorageCostHint
DAH: DataAvailabilityHint

FIG.10A

385

VOLUME NUMBER	FC I/F NUMBER	CAPACITY	BANDWIDTH	VOLUME HINT INFORMATION			EXTERNAL STORAGE SUBSYSTEM	
				ABH	SCH	DAH	FC I/F NUMBER	VOLUME NUMBER
3432	3738	200GB	2Gbps	10	0	10	3714	3412
3431	3737	200GB	1Gbps	1	10	0	3711	3411

FIG.10B

385

VOLUME NUMBER	FC I/F NUMBER	CAPACITY	BANDWIDTH	VOLUME HINT INFORMATION			EXTERNAL STORAGE SUBSYSTEM	
				ABH	SCH	DAH	FC I/F NUMBER	VOLUME NUMBER
3432	3738	200GB	2Gbps	10	0	10	3714	3412
3431	3737	200GB	1Gbps	1	10	0	3711	3411
3439	0	200GB	10Gbps	10	0	10	0	0

FIG.10C

385

VOLUME NUMBER	FC I/F NUMBER	CAPACITY	BANDWIDTH	VOLUME HINT INFORMATION			EXTERNAL STORAGE SUBSYSTEM	
				ABH	SCH	DAH	FC I/F NUMBER	VOLUME NUMBER
3431	3737	200GB	1Gbps	1	10	0	3711	3411
3432	3738	200GB	10Gbps	10	0	10	0	0

FIG.11

115

DRIVE LETTER	FC INTERFACE NUMBER	VOLUME NUMBER	MIGRATION FLAG
C	3738	3432	0
D	3737	3431	0

FIG.12

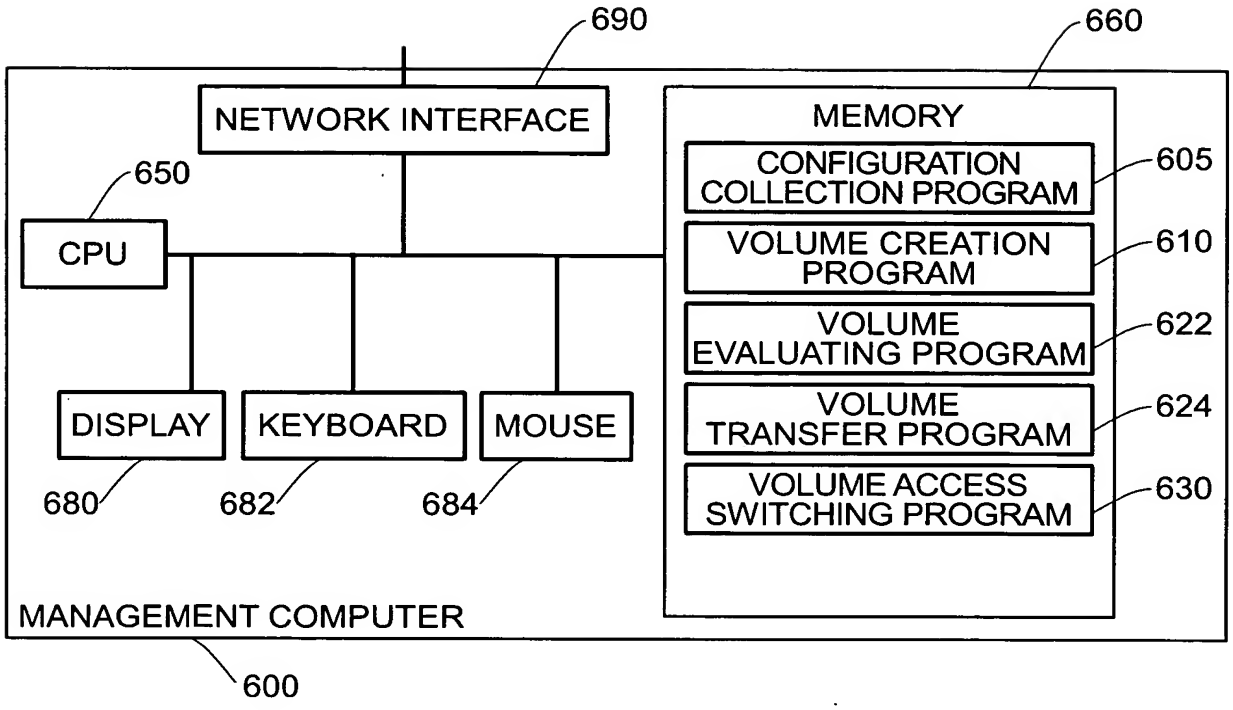

690
660
NETWORK INTERFACE
MEMORY
650
CONFIGURATION COLLECTION PROGRAM
605
CPU
VOLUME CREATION PROGRAM
610
VOLUME EVALUATING PROGRAM
622
DISPLAY
KEYBOARD
MOUSE
VOLUME TRANSFER PROGRAM
624
680
682
684
VOLUME ACCESS SWITCHING PROGRAM
630
MANAGEMENT COMPUTER
600

FIG.13

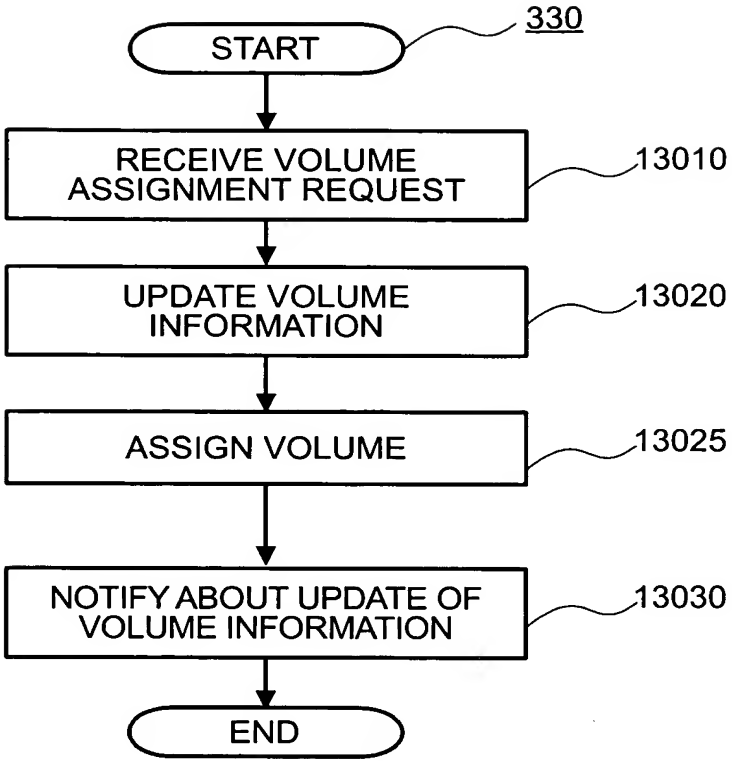

330
START
RECEIVE VOLUME ASSIGNMENT REQUEST
13010
UPDATE VOLUME INFORMATION
13020
ASSIGN VOLUME
13025
NOTIFY ABOUT UPDATE OF VOLUME INFORMATION
13030
END

FIG.14

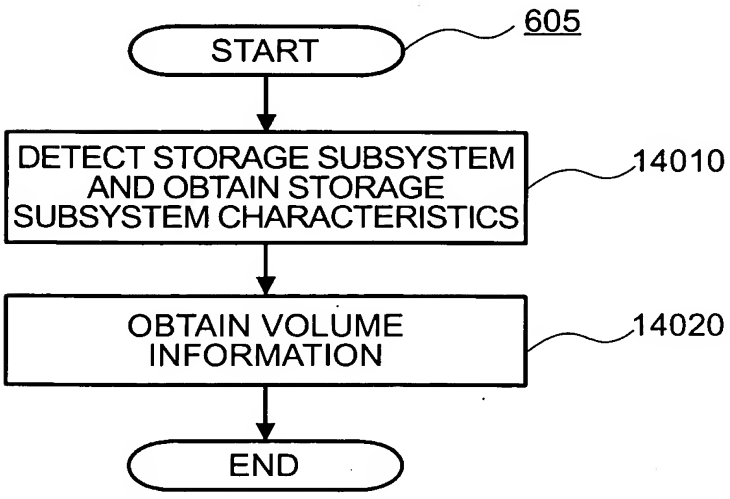

605
START
DETECT STORAGE SUBSYSTEM AND OBTAIN STORAGE SUBSYSTEM CHARACTERISTICS
14010
OBTAIN VOLUME INFORMATION
14020
END

FIG.15

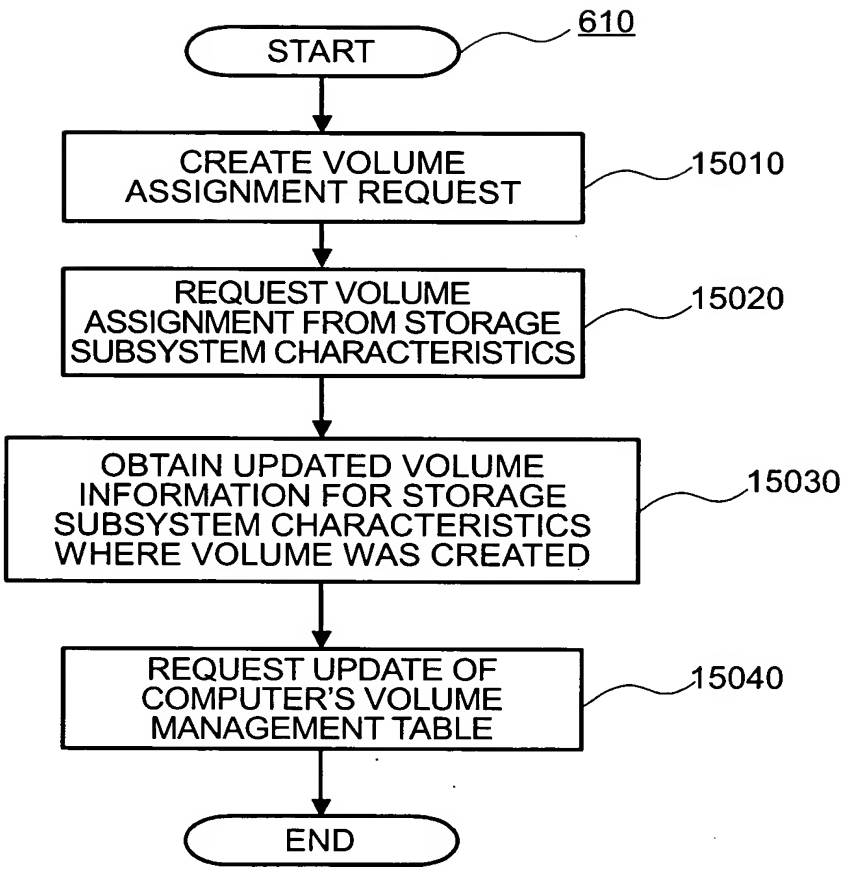

610
START
CREATE VOLUME ASSIGNMENT REQUEST
15010
REQUEST VOLUME ASSIGNMENT FROM STORAGE SUBSYSTEM CHARACTERISTICS
15020
OBTAIN UPDATED VOLUME INFORMATION FOR STORAGE SUBSYSTEM CHARACTERISTICS WHERE VOLUME WAS CREATED
15030
REQUEST UPDATE OF COMPUTER'S VOLUME MANAGEMENT TABLE
15040
END

FIG.16

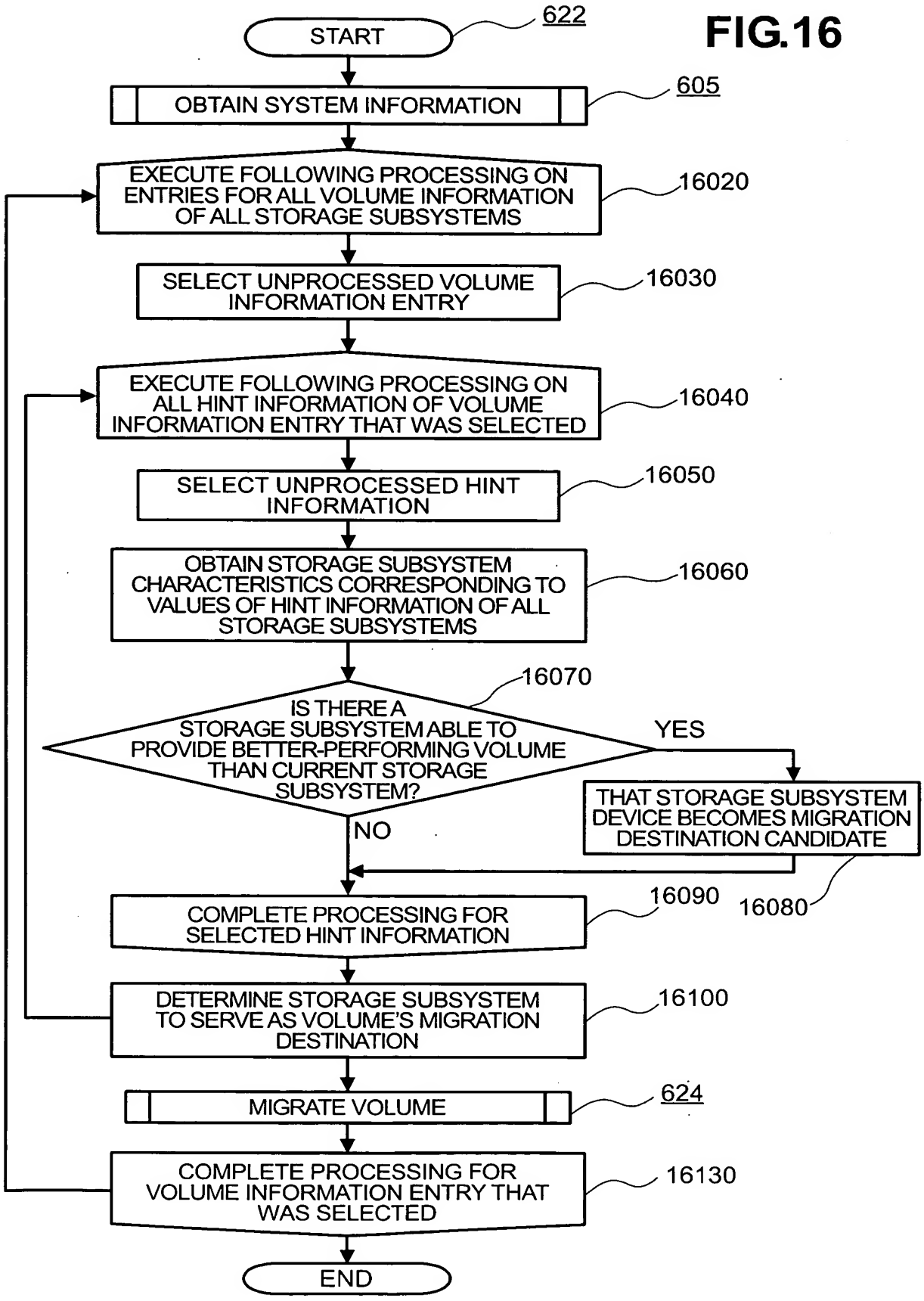

622
START
OBTAIN SYSTEM INFORMATION
605
EXECUTE FOLLOWING PROCESSING ON ENTRIES FOR ALL VOLUME INFORMATION OF ALL STORAGE SUBSYSTEMS
16020
SELECT UNPROCESSED VOLUME INFORMATION ENTRY
16030
EXECUTE FOLLOWING PROCESSING ON ALL HINT INFORMATION OF VOLUME INFORMATION ENTRY THAT WAS SELECTED
16040
SELECT UNPROCESSED HINT INFORMATION
16050
OBTAIN STORAGE SUBSYSTEM CHARACTERISTICS CORRESPONDING TO VALUES OF HINT INFORMATION OF ALL STORAGE SUBSYSTEMS
16060
16070
IS THERE A STORAGE SUBSYSTEM ABLE TO PROVIDE BETTER-PERFORMING VOLUME THAN CURRENT STORAGE SUBSYSTEM?
YES
NO
THAT STORAGE SUBSYSTEM DEVICE BECOMES MIGRATION DESTINATION CANDIDATE
16080
COMPLETE PROCESSING FOR SELECTED HINT INFORMATION
16090
DETERMINE STORAGE SUBSYSTEM TO SERVE AS VOLUME'S MIGRATION DESTINATION
16100
MIGRATE VOLUME
624
COMPLETE PROCESSING FOR VOLUME INFORMATION ENTRY THAT WAS SELECTED
16130
END

FIG.17

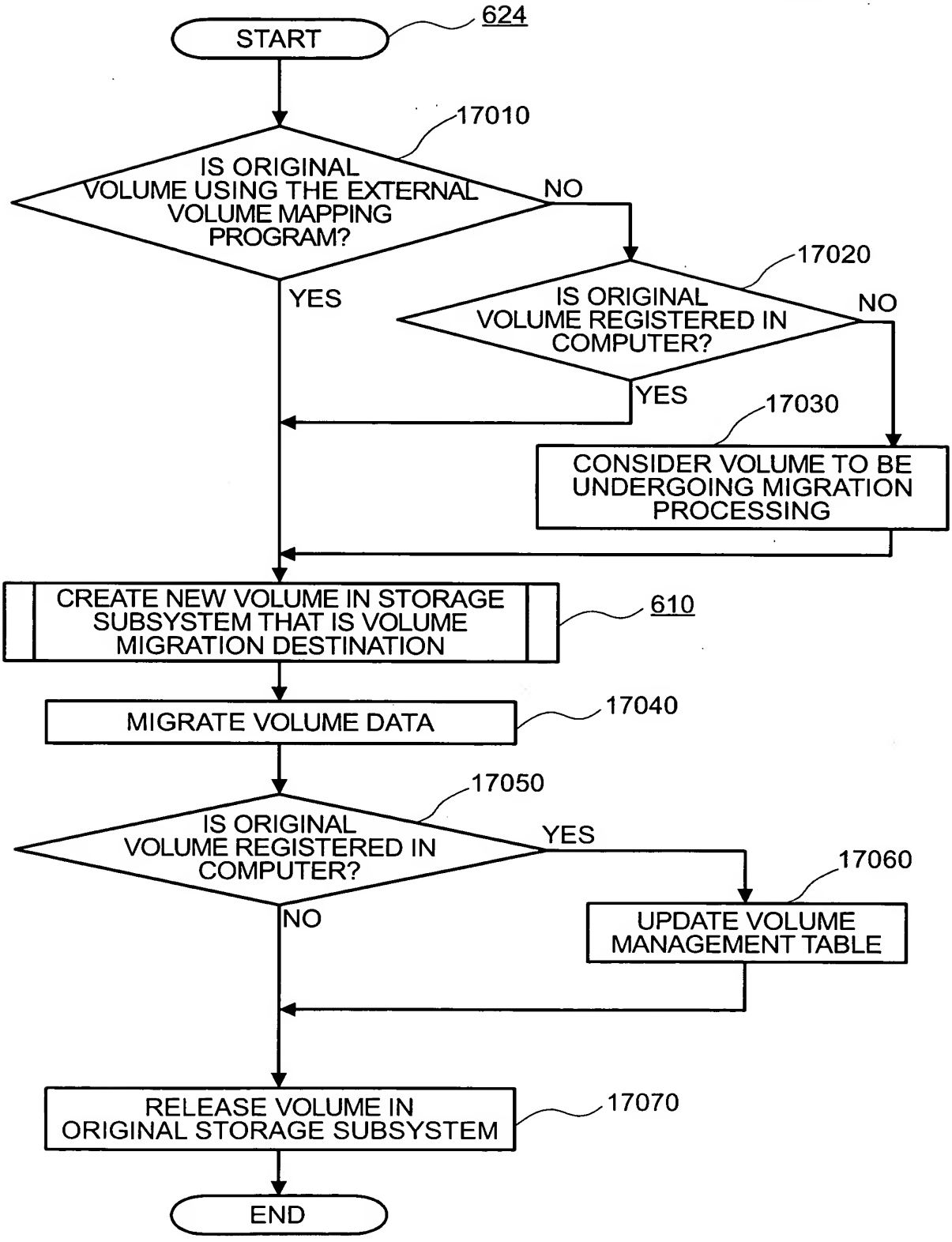

624
START
17010
IS ORIGINAL VOLUME USING THE EXTERNAL VOLUME MAPPING PROGRAM?
NO
YES
17020
IS ORIGINAL VOLUME REGISTERED IN COMPUTER?
NO
YES
17030
CONSIDER VOLUME TO BE UNDERGOING MIGRATION PROCESSING
CREATE NEW VOLUME IN STORAGE SUBSYSTEM THAT IS VOLUME MIGRATION DESTINATION
610
MIGRATE VOLUME DATA
17040
17050
IS ORIGINAL VOLUME REGISTERED IN COMPUTER?
YES
NO
17060
UPDATE VOLUME MANAGEMENT TABLE
RELEASE VOLUME IN ORIGINAL STORAGE SUBSYSTEM
17070
END

FIG.18

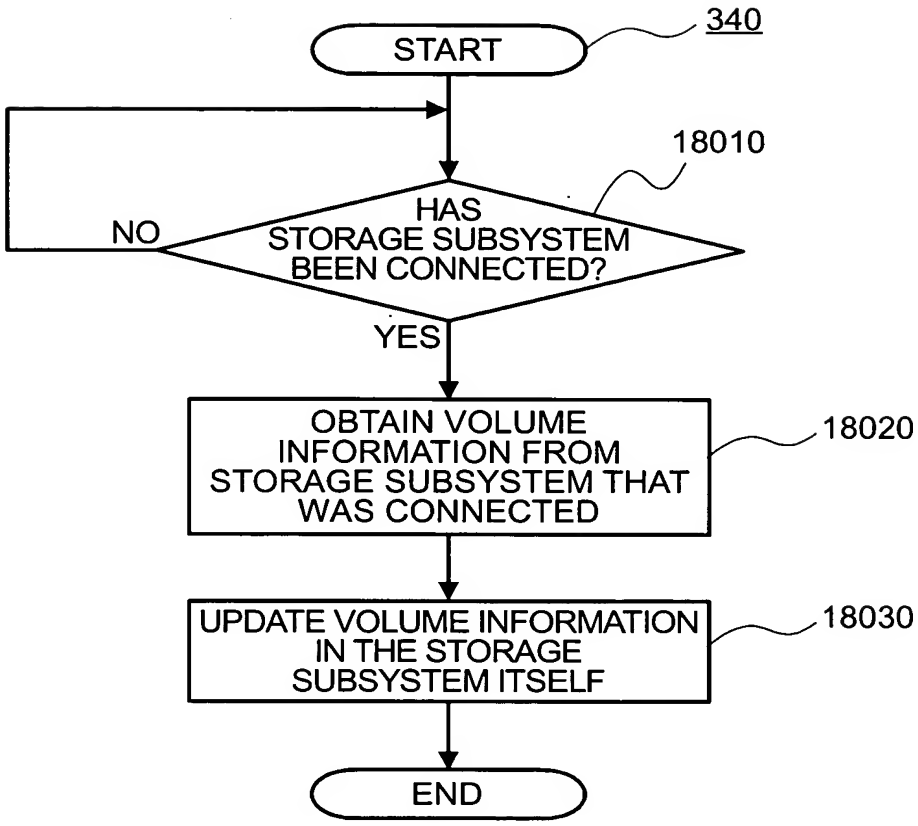

340
START
18010
HAS STORAGE SUBSYSTEM BEEN CONNECTED?
NO
YES
OBTAIN VOLUME INFORMATION FROM STORAGE SUBSYSTEM THAT WAS CONNECTED
18020
UPDATE VOLUME INFORMATION IN THE STORAGE SUBSYSTEM ITSELF
18030
END

FIG.19

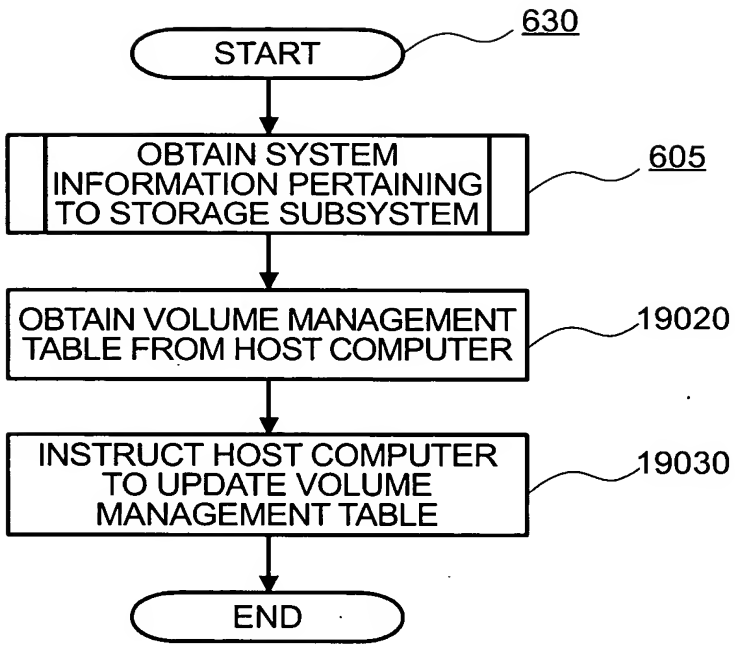

630
START
OBTAIN SYSTEM INFORMATION PERTAINING TO STORAGE SUBSYSTEM
605
OBTAIN VOLUME MANAGEMENT TABLE FROM HOST COMPUTER
19020
INSTRUCT HOST COMPUTER TO UPDATE VOLUME MANAGEMENT TABLE
19030
END

FIG.20

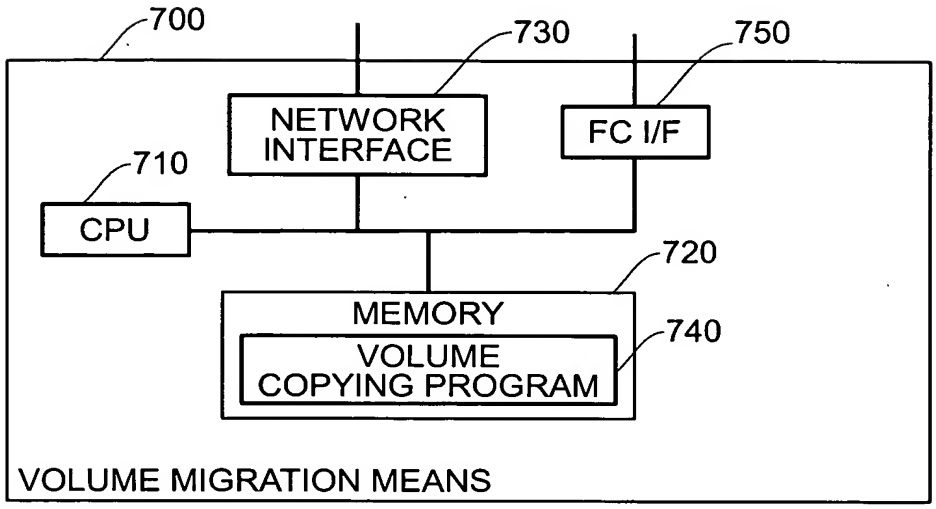
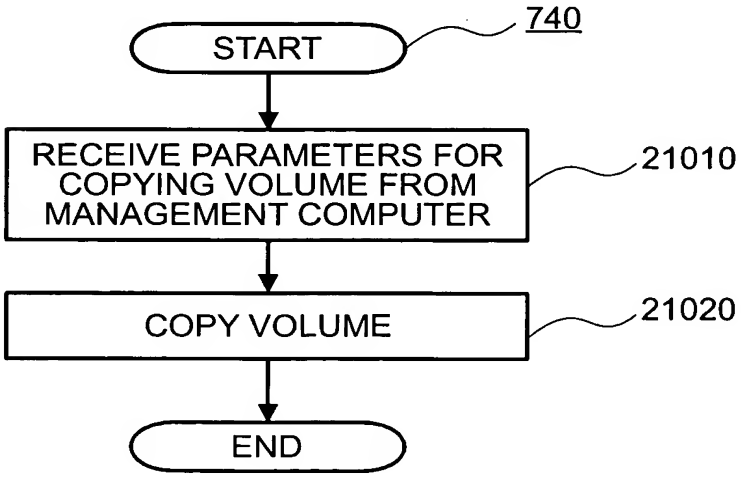

700
730
750
NETWORK INTERFACE
FC I/F
710
CPU
720
MEMORY
740
VOLUME COPYING PROGRAM
VOLUME MIGRATION MEANS

FIG.21


740
START
RECEIVE PARAMETERS FOR COPYING VOLUME FROM MANAGEMENT COMPUTER
21010
COPY VOLUME
21020
END